Appendix C
Guide Specification

GUIDE SPECIFICATION

FOR

DEFORMATION MONITORING AND CONTROL SURVEYING ACTIVITIES

INSTRUCTIONS

1. General. This guide specification is intended for use in preparing Architect-Engineer (A-E) contracts for control survey services. These specifications are applicable to all surveying and mapping contracts used to support US Army Corps of Engineers (USACE) civil works design, construction, operations, maintenance, regulatory, and real estate activities. This guide specification is intended for contracts which are obtained using PL 92-582 (Brooks Act) qualification-based selection procedures.

2. Coverage. This guide specification contains the technical standards and/or references necessary to specify control survey requirements. This guide supports all types of control surveying performed on USACE projects.

3. Applicability. The following types of negotiated A-E contract actions are supported by these instructions:

a. Fixed-price control survey service contracts.

b. Indefinite delivery type (IDT) control survey contracts.

c. A multi-discipline surveying and mapping IDT contract in which control survey services is a line item supporting other surveying, mapping, and/or photogrammetry services.

d. A work order or delivery order placed against an IDT contract.

e. Design and design-construct contracts that include incidental surveying and mapping services (including Title II services). Both fixed-price and IDT contracts are supported by these instructions.

4. Contract Format. The contract format outlined in this guide follows that prescribed in the current edition of the Engineer Federal Acquisition Regulation Supplement (EFARS). The contract format is designed to support PL 92-582 (SF 252) qualification-based A-E procurement actions.

5. General Guide Use. In adapting this guide specification to any project, specific requirements will be changed as necessary for the work contemplated. Changes will be made by deletions or insertions within this format. With appropriate adaptation, this guide form may be tailored for direct input in the Standard Army Automated Contracting System (SAACONS). Clauses and/or provisions shown in this guide will be renumbered during SAACONS input.

6. Insertion of Technical Specifications. Engineer Manual (EM) 1110-1-1004, Deformation Monitoring and Control Surveying should be attached to and made part of any service contract for control surveying. This manual contains complete specifications and quality control criteria for the total (field-to-finish) execution of these surveys.

a. Technical specifications for control surveying that are specific to the project (including items such as the scope of work, procedural requirements, and accuracy requirements) will be placed under Section C of the SF 252 (Block 10). The prescribed format for developing the technical specifications is contained in this guide specification. Project-specific technical specifications will not contain contract administrative functions -- these should be placed in more appropriate sections of the contract.

b. Technical specifications for other survey functions required in a control survey services contract should be developed from other Civil Works Construction Guide Specifications applicable to the surveying and mapping discipline required.

c. Standards and other specifications should be checked for obsolescence and for dates and applicability of amendments and revisions issued subsequent to the publication of this specification. Use Engineer Pamphlet (EP) 25-1-1, Index of USACE/OCE Publications. Maximum use should be made of existing EM's, Technical Manuals, and other recognized industry standards and specifications.

d. Throughout Section C of this guide, the specification writer must elect a contract performance method:

(1) The Government designs the survey occupation/observing schedule.

(2) The contractor designs his performance method based on the criteria given in EM 1110-1-1004.

Selection of the first method depends on the survey expertise of the specification writer. This method also transfers much of the contract risk to the Government. The second method is the preferred contract procedure.

7. Alternate Clauses/Provisions or Options. In order to distinguish between required clauses and optional clauses, required clauses are generally shown in capital letters. Optional or selective clauses, such as would be used in a work order, are generally in lower case. In other instances, alternate clauses/provisions may be indicated by brackets "[ ]" and/or clauses preceded by a single asterick "*". A single asterick signifies that a clause or provision which is inapplicable to the particular section may be omitted, or that a choice of clauses may be made depending upon the technical surveying and mapping requirement. Clauses requiring insertion of descriptive material or additional project-specific specifications are indicated by either ellipsis or underlining in brackets (e.g., "[. . .]" "[____]"). In many instances, explanatory notes are included regarding the selection of alternate clauses or provisions.

8. Notes and Comments. General comments and instructions used in this guide are contained in asterisk blocks. These comments and instructions should be removed from the final contract.

9. Indefinite Delivery Type (IDT) Contracts and Individual Work Order Assignments. Contract clauses which pertain to IDT contracts, or delivery orders thereto, are generally indicated by notes adjacent to the provision. These clauses should be deleted for fixed-price contracts. In general, sections dealing with IDT contracts are supplemented with appropriate comments pertaining to their use. Work orders against a basic IDT contract may be constructed using the format contained in Section C of this guide. This contract section is therefore applicable to any type of surveying service contracting action.

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THE CONTRACT SCHEDULE

SECTION A

SOLICITATION/CONTRACT FORM

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NOTE: Include here Standard Form 252 in accordance with the instructions in EFARS.

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SF 252 -- (Block 5): PROJECT TITLE AND LOCATION

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NOTE: Sample title for fixed-price contract:

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PRIMARY GEODETIC CONTROL SURVEYS IN SUPPORT OF SITE PLAN MAPPING FOR PRELIMINARY
CONCEPT DESIGN OF FAMILY HOUSING COMPLEX BETA, FORT _____, VIRGINIA.

PRIMARY GEODETIC REFERENCE SURVEYS FOR BOUNDARY DEMARCATION SURVEYS OF _____[PROJECT], _____, OHIO.

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NOTE: Sample title for indefinite delivery type contract:

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INDEFINITE DELIVERY CONTRACT FOR PROFESSIONAL PRECISE SURVEYING SERVICES IN SUPPORT
OF VARIOUS *[CIVIL WORKS] [MILITARY CONSTRUCTION] PROJECTS *[IN] [ASSIGNED TO] THE
_____ DISTRICT.

SECTION B

SERVICES AND PRICES/COSTS

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NOTE: The fee schedule for control survey services should be developed in conjunction with the preparation of the independent government estimate (IGE) along with the technical specifications. Procedures for determining unit costs are described in EM 1110-1-1004. Determination of estimated unit costs/prices should conform to the detailed analysis method, or "seven-item breakdown," as described in this manual and other USACE publications. The fee schedule should follow the general unit price example format shown below, which is more fully described in EM 1110-1-1004. Select only those line items applicable to a particular contract or project. A separate fee schedule for each option period should be developed and negotiated during contract negotiations and included with the contract during initial award.

Daily Rate Schedule Example: For IDT contracts, a unit quantity for each line item would normally be negotiated. Actual quantities would be used on a fixed price contract. Daily units of measure (U/M) may be modified to hourly or other nominal units if needed. Prices may also be scheduled on a work unit basis (e.g., linear miles, feet, per section, area, etc.) as described in EM 1110-1-1004.

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Price per Control Point/Station Schedule Example:

ITEM	DESCRIPTION	QUAN	U/M	U/P	AMOUNT
0001	Horizontal Control Station, 2nd Order, Class I	[1]	Station		
0002	Horizontal Control Station, 2nd Order, Class II	[1]	Station		
0003	Horizontal Control Station, 3rd Order, Class I	[1]	Station		
0004	Horizontal Control Station, 3rd Order, Class II	[1]	Station		
0005	Vertical Control Station, 2rd Order, Class I	[1]	Station		
0006	Vertical Control Station, 2nd Order, Class II	[1]	Station		
0007	Vertical Control Station, 3rd Order	[1]	Station		
00XX					

Daily Rate Schedule Example:

ITEM	DESCRIPTION	QUAN	U/M	U/P	AMOUNT
0001	Registered/Licensed Land Surveyor -- Office	[1]	Day		
0002	Registered/Licensed Land Surveyor -- Field	[1]	Day		
0003	Civil Engineering Technician -- Field Party Supervisor (Multiple Crews)	[1]	Day		
0004	Engineering Technician (Draftsman) -- Office/Field	[1]	Day		
0005	Supervisory Survey Technician (Field)	[1]	Day		
0006	Survey Technician -- Instrument Man/Recorder	[1]	Day		

0007	Surveying Aid -- Rodman/Chainman (Conventional Surveys)	[1]	Day		
0008	[Two][Three][Four][___] - Man GPS Survey Party [___] GPS Receiver(s) [___] Vehicle(s) [___] Computer(s)	[1]	Day		
0009	Additional GPS Receiver	[1]	Day		
0010	[___] - Man Automated (Electronic) Survey Party	[1]	Day		
0011	[___] - Man Conventional Horizontal Control Survey Party	[1]	Day		
0012	[___] - Man Conventional Vertical Control Survey Party	[1]	Day		
0013	Station Monuments [Disk Type] [Construction Materials]	[1]	EA		
0014	Survey Computer (Office)	[1]	Day		
0015	CADD Processing & Plotting	[1]	Day		
0016	Professional Geodesist Computer (Office)	[1]	Day		
0017	Blue Line Prints	[1]	SQ FT		
00XX					

SECTION C

STATEMENT OF WORK

C.1 GENERAL. THE CONTRACTOR, OPERATING AS AN INDEPENDENT CONTRACTOR AND NOT AN AGENT OF THE GOVERNMENT, SHALL PROVIDE ALL LABOR, MATERIAL, AND EQUIPMENT NECESSARY TO PERFORM THE PROFESSIONAL CONTROL SURVEYING *[AND MAPPING WORK] *[FROM TIME TO TIME] DURING THE PERIOD OF SERVICE AS STATED IN SECTION D, IN CONNECTION WITH PERFORMANCE OF *[_____] SURVEYS *[AND THE PREPARATION OF SUCH MAPS] AS MAY BE REQUIRED FOR *[ADVANCE PLANNING,] [DESIGN,] [AND CONSTRUCTION] [or other function] [ON VARIOUS PROJECTS] *[specify project(s)] . THE CONTRACTOR SHALL FURNISH THE REQUIRED PERSONNEL, EQUIPMENT, INSTRUMENTS, AND TRANSPORTATION AS NECESSARY TO ACCOMPLISH THE REQUIRED SERVICES AND FURNISH TO THE GOVERNMENT REPORTS AND OTHER DATA TOGETHER WITH SUPPORTING MATERIAL DEVELOPED DURING THE FIELD DATA ACQUISITION PROCESS. DURING THE PROSECUTION OF THE WORK, THE CONTRACTOR SHALL PROVIDE ADEQUATE PROFESSIONAL SUPERVISION AND QUALITY CONTROL TO ASSURE THE ACCURACY, QUALITY, COMPLETENESS, AND PROGRESS OF THE WORK.

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NOTE: The above clause is intended for use on an IDT contract for control survey services (as applicable). It may be used for fixed-price service contract by deleting appropriate IDT language and adding the specific project survey required. This clause is not repeated on individual delivery orders.

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C.2 LOCATION OF WORK.

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NOTE: Use the following clause for a fixed-scope contract or individual work order.

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C.2.1. A *[PROJECT CONDITION] [PLANS AND SPECIFICATIONS] [____] [specify type] CONTROL SURVEY IS REQUIRED AT [_____] [list project area or areas required]. *[A GENERAL LOCATION MAP OF THE PROJECT AREA IS ATTACHED AT SECTION G OF THIS CONTRACT.]

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NOTE: Use the following when specifying an indefinite delivery contract for control surveying.

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C.2.2. CONTROL SURVEYING SERVICES WILL BE PERFORMED IN CONNECTION WITH PROJECTS *[LOCATED IN] [ASSISGNED] TO THE [_____] DISTRICT. *[THE _____ DISTRICT INCLUDES THE GEOGRAPHICAL REGIONS WITHIN *[AND COASTAL WATERS] [AND RIVER SYSTEMS] ADJACENT TO:]

*_____

[list states, regions, etc.]

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NOTE: Note also any local points-of-contact, right-of-entry requirements, clearing restrictions, installation security requirements, etc.

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C.3 TECHNICAL CRITERIA AND STANDARDS.

REFERENCE STANDARDS:

C.3.1. U.S. ARMY CORPS OF ENGINEERS ENGINEER MANUAL (EM) 1110-1-1004, DEFORMATION MONITORING AND CONTROL SURVEYING. THIS REFERENCE IS ATTATCHED TO AND MADE PART OF THIS CONTRACT (SEE SECTION G).

C.3.2. U.S. ARMY CORPS OF ENGINEERS EM 1110-1-1002, SURVEY MARKERS AND MONUMENTATION. *[THIS REFERENCE IS ATTACHED TO AND MADE PART OF THIS CONTRACT. (SEE CONTRACT SECTION G).]

C.3.3. *U.S. ARMY CORPS OF ENGINEERS STANDARDS AND SPECIFICATIONS FOR SURVEYS, MAPS, ENGINEERING DRAWINGS, AND RELATED SPATIAL DATA PRODUCTS *(cite current regulation).

C.3.4. *[Local Drafting Standards containing sheet sizes, types, formats, etc.]

C.3.5. *[List other applicable reference standards which are listed in Appendix A of EM 1110-1-1004 and may be applicable to the project.

****

NOTE: Reference may also be made to other applicable Engineer Manuals, CADD Standards, or other standard criteria documents. Such documents need not be attached to the Contract; if attached, however, reference should be made to their placement in contract Section G.

****

C.4 WORK TO BE PERFORMED. SPECIFIC PROCEDURAL, TECHNICAL, AND QUALITY CONTROL REQUIREMENTS FOR CONTROL SURVEYING *[AND MAPPING SERVICES] TO BE PERFORMED UNDER THIS CONTRACT ARE LISTED IN THE PARAGRAPHS BELOW. UNLESS OTHERWISE INDICATED IN THIS CONTRACT *[OR IN DELIVERY ORDERS THERETO], EACH REQUIRED SERVICE SHALL INCLUDE FIELD-TO-FINISH EFFORT PERFORMED IN ACCORDANCE WITH THE STANDARDS AND SPECIFICATIONS IN EM 1110-1-1004.

****

NOTE: The following clauses throughout paragraph C.4 may be used for either fixed-prices surveying service contracts, IDT work orders under an IDT surveying contract, or IDT where contract survey services are part of a schedule of various survey disciplines. Fixed-scope contracts: Detail specific hydrographic surveying and mapping technical work requirements and performance criteria which are necessary to accomplish the work. IDT contracts and work orders thereof: Since specific project scopes are indefinite at the time a basic contract is prepared, only general technical criteria and standards can be outlined. Project or site-specific criteria will be contained in each delivery order, along with any deviations from technical standards identified in the basic IDT contract. The clauses contained herein are used to develop the general requirements for a basic IDT contract. Susequent delivery orders will reference these clauses; adding project-specific work requirements as required. Delivery order formats should follow the outline established for the basic IDT contract.

****

C.4.1. GENERAL SURVEY REQUIREMENTS. SURVEYS WILL BE PERFORMED USING CONTROL SURVEY METHODS. SUCH METHODS WILL BE MADE IN STRICT ACCORDANCE WITH THE CRITERIA CONTAINED IN EM 1110-1-1004, EXCEPT AS MODIFICED OR AMPLIFIED HEREIN. THE METHOD USED WILL BE *[CARRIER PHASE BASED GPS SURVEY METHODS UTILIZING STATIC *[STOP-AND-GO] *[KINEMATIC] *[PSEUDO-KINEMATIC] TECHNIQUES *[OR COMBINATIONS THEREOF]] *[CONVENTIONAL SURVEY METHODS]. *[CONVENTIONAL SURVEY METHODS WILL BE USED TO DENSIFY SUPPLEMENTAL POINTS RELATIVE TO ESTABLISHED GPS STATIONS.]

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NOTE: For fixed-scope contracts and/or delivery orders, use the following types of clauses to detail the general work specifications. Terminology would be appropriately modified to cover the type of survey to be done. A general description of the project and any unique purpose of the survey may also be added.

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C.4.2. HORIZONTAL ACCURACY REQUIREMENTS. NEW *[PRIMARY] STATIONS SHALL BE ESTABLISHED TO A *[_____]-ORDER, *[CLASS *[___]] RELATIVE ACCURACY CLASSIFICATION *[OR ____ PART IN _____]. *[SUPPLEMENTAL POINTS SHALL BE ESTABLISHED TO A *[_____]-ORDER, *[CLASS *[___]] RELATIVE ACCURACY CLASSIFICATION. HORIZONTAL ACCURACY REQUIREMENTS SPECIFIED FOR NEWLY POSITIONED STATIONS SHALL BE BASED ON A FREE (UNCONSTRAINED) ADJUSTMENT OF SURVEY OBSERVATIONS AND SHALL MEET THE RELATIVE ACCURACY AND/OR LOOP MISCLOSURE CRITERIA INDICATED IN EM 1110-1-1004.

****

NOTE: Note that accuracy classifications and related contract quality control and acceptance are based on a free adjustment of the work -- not a constrained adjustment to fixed/existing control. If using GPS to establish primary control, it is often the case that GPS will often give horizontal accuracies exceeding those of the control used to establish the GPS point, especially if the basic control (i.e., reference control) has been established by conventional survey techniques. Horizontal accuracy classifications exceeding Second-Order, Class I (i.e., 1:50,000) will not normally be specified for USACE control work.

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C.4.3. VERTICAL ACCURACY REQUIREMENTS. NEW *[PRIMARY] STATIONS SHALL BE ESTABLISHED TO A
*[_____]-ORDER, *[CLASS *[___]] RELATIVE ACCURACY CLASSIFICATION *[OR ____ PART IN _____]. *[SUPPLEMENTAL POINTS SHALL BE ESTABLISHED TO A *[_____]-ORDER, *[CLASS *[___]] RELATIVE ACCURACY CLASSIFICATION. VERTICAL ACCURACY REQUIREMENTS SPECIFIED FOR NEWLY POSITIONED STATIONS SHALL BE BASED ON A FREE (UNCONSTRAINED) ADJUSTMENT OF SURVEY OBSERVATIONS AND SHALL MEET THE RELATIVE ACCURACY AND/OR LOOP MISCLOSURE CRITERIA INDICATED IN EM 1110-1-1004.

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NOTE: When using GPS techniques to establish vertical elevations, extreme caution must be employed -- its application for engineering and contruction work is limited. Refer to EM 1110-1-1003 prior to developing specifications for GPS vertical control densification.

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C.4.4. PROCEDURAL OBSERVATION REQUIREMENTS. NETWORK DESIGN, STATION OCCUPATION REQUIREMENTS, BASELINE REDUNDANCIES, AND CONNECTION REQUIREMENTS TO EXISTING NETWORKS SHALL FOLLOW THE CRITERIA GIVEN IN EM 1110-1-1004, EXCEPT AS MODIFIED IN THESE SPECIFICATIONS.

****
NOTE: At this point, indicate any exceptions, modifications, and/or deviations from the criteria in EM 1110-1-1004. The specification writer may optionally elect to have the contractor design his observing procedures in accordance with general EM 1110-1-1004 criteria. Alternatively, specific baselines or stations requiring occupation may be specified. Use of either option depends on the surveying experience/expertise of the specification writer. The preferred method is to allow the maximum flexibility for the contractor to determine the most optimum network design (interconnections, traverses, loops, spurs, etc.). In specifying baselines/points that have been monumented, contingencies should be allowed for resetting marks and/or eccentric observations due to obscured satellite visibility.
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C.4.5. *SPECIFIC BASELINES TO BE MEASURED.

****
NOTE: Use the above clause only if the government specification writer is designing the network.
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*(1) THE FOLLOWING BASELINES SHALL BE OBSERVED ON THIS PROJECT: [...] *[list specific station-station baselines and any requirements for redundant observations]

*(2) THESE BASELINES ARE INDICATED BY [...] *[specify line symbol] ON THE ATTACHED MAP IN SECTION G.

C.4.6. NEW STATIONS TO BE *[MONUMENTED AND] OCCUPIED.

(1) THE FOLLOWING *[...] *[indicate number of] STATIONS ARE TO BE OCCUPIED AND POSITIONED USING *[indicate survey method] SURVEY TECHNIQUES: *[list/tabulate new station name and/or area designation, accuracy requirements (order/class), redundant occupations, etc.]

(2) THE NEW STATION *[GENERAL LOCATIONS] ARE INDICATED WITH A *[...] *[indicate map symbol used] ON THE ATTACHED MAP. *[ACTUAL STATION LOCATION WITHIN THE GENERALLY DEFINED AREA SHALL BE SELECTED BY THE CONTRACTOR AND SHALL BE LOCATED SUCH THAT ADEQUATE INTERVISIBILITY (AS REQUIRED) IS AFFORDED.]

C.4.7. EXISTING NETWORK CONTROL STATIONS TO BE OCCUPIED AND CONNECTED.

(1) A TOTAL OF *[...] *[specify number of] EXISTING HORIZONTAL CONTROL STATIONS WILL BE USED TO REFERENCE HORIZONTAL OBSERVATIONS ON THIS SURVEY. A LISTING OF THESE FIXED POINTS *[IS SHOWN BELOW] [IS SHOWN IN ATTACHMENT G.*] FIXED COORDINATES ARE *[NAD 27] [NAD 83] [WGS 84 GEOCENTRIC] [...].

****
NOTE: List each existing control station(s) or, alternately, refer to a map or tabulation attachment in contract Section G.
****

(2) A TOTAL OF *[...] [specify number] VERTICAL CONTROL STATIONS (BENCHMARKS) WILL BE OCCUPIED AND USED TO CONTROL AND/OR PROVIDE VERTICAL ORIENTATION REFERENCE TO VERTICAL OBSERVATIONS ON THIS SURVEY. A LISTING OF THESE FIXED BENCHMARKS *[IS SHOWN BELOW] [IS SHOWN IN ATTACHMENT G*]. ELEVATIONS FOR ALL FIXED BENCHMARKS ARE BASED ON *[NGVD 29] [IGLD-55] [NAVD 88] [IGLD-85] [...] DATUM.

****
NOTE: List or reference attachment for existing benchmarks.
****

(3) REQUIRED BASELINE CONNECTIONS TO EXISTING CONTROL ARE SHOWN *[IN SECTION G]. THESE FIXED POINTS WILL BE USED IN PERFORMING A FINAL CONSTRAINED ADJUSTMENT OF ALL NEW WORK. HORIZONTAL POINTS ARE INDICATED BY A [...], VERTICAL POINTS BY A [...], COMBINED POINTS BY A [...], AND NEW BASELINES BY A [...].

****
NOTE: Use the above clause when existing control points to be connected are specified in the contract.
****

(4) ALL HORIZONTAL AND VERTICAL MONUMENTS ARE KNOWN TO BE IN PLACE AS OF *[date]. DESCRIPTIONS FOR EACH POINT *[ARE ATTACHED AT CONTRACT SECTION G]. THE SOURCE AGENCY AND ESTIMATED ACCURACY OF EACH POINT ARE INDICATED ON THE DESCRIPTION. *[IF VISIBILITY BETWEEN POINTS IS OBSCURED FROM AN EXISTING STATION TO ONE TO BE ESTABLISHED BY THIS CONTRACT, THEN A NEW MARK SHALL BE SET AT THE RATE FOR ITEM [___] IN SECTION B.] *[THE CONTRACTOR'S FIELD REPRESENTATIVE SHALL IMMEDIATELY NOTIFY THE GOVERNMENT'S CONTRACTING OFFICER'S REPRESENTATIVE IF EXISTING CONTROL POINTS HAVE BEEN DISTURBED AND/OR CONDITIONS ARE NOT AS INDICATED IN THE FURNISHED DESCRIPTIONS].

****
NOTE: Use the following clause(s) only when network design and observation schedule/sequence will be determined by the contractor.
****

(5) UNLESS OTHERWISE SPECIFIED IN THESE INSTRUCTIONS, AT LEAST *[ONE] [TWO] [THREE] [___] EXISTING (PUBLISHED) CONTROL STATIONS MUST BE OCCUPIED IN THE NETWORK. CONNECTION METHODS AND REDUNDANCY ARE AT THE CONTRACTOR'S OPTION. PRIOR TO USING ANY CONTROL POINTS, THE MONUMENTS SHALL BE CHECKED TO ENSURE THAT THEY HAVE NOT BEEN MOVED OR DISTURBED.

C.4.8. NEW STATION MONUMENTATION, MARKING, AND OTHER CONTROL REQUIREMENTS.

(1) ALL STATIONS SHALL BE MONUMENTED IN ACCORDANCE WITH EM 1110-1-1002, SURVEY MARKERS AND MONUMENTATION. MONUMENTATION FOR THIS PROJECT SHALL BE TYPE *[...] FOR HORIZONTAL AND TYPE *[...] FOR VERTICAL, PER EM 1110-1-1002 CRITERIA. *[MONUMENTATION SHALL BE DEFINED TO INCLUDE THE REQUIRED REFERENCE MARKS AND AZIMUTH MARKS REQUIRED BY EM 1110-1-1004.] *[ALL MONUMENTS FOR NEW STATIONS ARE CURRENTLY IN PLACE AND DESCRIPTIONS ARE ATTACHED AT SECTION G.]

****
NOTE: Deviations from EM 1110-1-1004 should be indicated as required. USACE project control rarely requires supplemental reference/azimuth marks -- the optional specification clauses below should be tailored accordingly.
****

*(2) AT EACH STATION, ANGLE AND DISTANCE MEASUREMENTS SHALL BE MADE BETWEEN A NETWORK STATION AND REFERENCE MARKS AND AZIMUTH MARKS SET WHICH WERE ESTABLISHED IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN EM 1110-1-1004. ANGULAR AND DISTANCE MEASUREMENT PROCEDURES FOR REFERENCE/AZIMUTH MARKS

SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS SET FORTH IN FGCS STANDARDS AND SPECIFICATIONS FOR GEODETIC CONTROL NETWORKS. ALL OBSERVATIONS SHALL BE RECORDED IN A STANDARD FIELD BOOK.

*(a) FOR REFERENCE MARKS, TWO (2) DIRECTIONAL POSITIONS ARE REQUIRED (REJECT LIMIT ±10-SECOND ARC) AND WITH STEEL TAPING PERFORMED TO THE NEAREST ±0.01 FOOT.

*(b) FOUR DIRECTIONAL POSITIONS ARE REQUIRED TO AZIMUTH MARKS. THE REJECT LIMIT FOR A 1-SECOND THEODOLITE IS ±5 SECONDS. AZIMUTH MARK LANDMARKS SHALL BE EASILY DEFINED/DESCRIBED NATURAL FEATURES OR STRUCTURES WHICH ARE OF SUFFICIENT DISTANCE TO MAINTAIN A *[± ___]-SECOND ANGULAR ACCURACY. *[_____-ORDER ASTRONOMIC AZIMUTHS SHALL BE OBSERVED TO AZIMUTH MARKS.]

*(c) A COMPASS READING SHALL BE TAKEN AT EACH STATION TO REFERENCE MONUMENTS AND AZIMUTH MARKS.

C.4.9. STATION DESCRIPTION AND RECOVERY REQUIREMENTS.

(1) STATION DESCRIPTIONS AND/OR RECOVERY NOTES SHALL BE WRITTEN IN ACCORDANCE WITH THE INSTRUCTIONS CONTAINED IN EM 1110-1-1002. [FORM *[_____] SHALL BE USED FOR THESE DESCRIPTIONS.] DESCRIPTIONS SHALL BE *[WRITTEN] [TYPED].

(2) DESCRIPTIONS *[ARE] [ARE NOT] REQUIRED FOR *[EXISTING] [AND/OR NEWLY ESTABLISHED] STATIONS.

(3) RECOVERY NOTES *[ARE] [ARE NOT] REQUIRED FOR EXISTING STATIONS.

C.4.10. MINIMUM OCCUPATION TIMES FOR OCCUPIED BASELINES. BASELINES SHALL BE OCCUPIED FOR A PERIOD OF TIME WHICH IS CONSISTENT WITH THE SPECIFIED ACCURACY REQUIREMENT FOR THE PROJECT AND/OR PARTICULAR NEW STATION/LINE. SPECIFIC OCCUPATION TIMES CONSISTENT WITH THE ACCURACY REQUIREMENTS ARE BASED ON THE PROCEDURES TO BE FOLLOWED FOR THE SURVEY, AS DETAILED IN EM 1110-1-1004. UNLESS OTHERWISE STATED IN THESE SPECIFICATIONS, THE CRITERIA SHOWN IN THIS MANUAL SHALL BE FOLLOWED FOR EACH PROJECT AND/OR OBSERVED BASELINE.

C.4.11. TYPE AND NUMBER OF SURVEYING EQUIPMENT TO BE DEPLOYED.

(1) THE CONTRACTING OFFICER RESERVES THE RIGHT TO REQUEST PUBLISHED DOCUMENTATION ON THE ACCURACY/QUALITY OF THE HARDWARE/SOFTWARE USED FOR THIS PROJECT. REPORTS PUBLISHED BY THE FGCS MAY BE REQUIRED. ALL SURVEY EQUIPMENT AND SOFTWARE USED UNDER THIS *[CONTRACT] [ASSIGNMENT] SHALL BE SUBJECT TO REVIEW BY THE CONTRACTING OFFICER. EQUIPMENT SUBJECT TO REVIEW SHALL INCLUDE:

(a) *[SPECIFIC SURVEYING EQUIPMENT. . . EDM, TOTAL STATION, LEVEL, ETC.]

(b) *[SPECIFIC SURVEYING EQUIPMENT]

(. . .)

*(2) A MINIMUM OF [. . .] *[SPECIFIC PIECE(S) OF SURVEYING EQUIPMENT] SHALL BE CONTINUOUSLY AND SIMULTANEOUSLY DEPLOYED DURING THIS *[ASSIGNMENT] [PROJECT].

C.4.12. FIELD OBSERVING RECORDING PROCEDURES.

(1) FIELD LOG *[SHEETS] [FORMS] [NOTES] SHALL BE COMPLETED FOR EACH STATION OF EACH SESSION AND SUBMITTED TO THE GOVERNMENT. MINIMUM DATA TO BE INCLUDED ON THESE FIELD LOG RECORDS ARE DESCRIBED IN CHAPTER 7 OF EM 1110-1-1004.

(2) RAW SURVEY DATA, BASELINE REDUCTION DATA, AND ADJUSTMENT SOLUTIONS SHALL BE RECORDED AND SUBMITTED TO THE GOVERNMENT ON *[_____-INCH FLOPPY DISKS] [A PREAPPROVED MEDIUM].

(3) IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO ASSURE THAT AMPLE OBSERVATIONS ARE CONDUCTED SO THAT ALL POINTS ARE INTERCONNECTED IN A COMPLETE INTERCONNECTING NETWORK OR TRAVERSE SURVEY AND/OR IN ACCORDANCE WITH THE REQUIRED BASELINE MEASUREMENTS SPECIFIED HEREIN. *[ADEQUATE FIELD COMPUTATIONAL CAPABILITY SHALL EXIST IN ORDER TO VERIFY MISCLOSURES PRIOR TO SITE DEPARTURE.]

C.4.13. BASELINE DATA REDUCTION REQUIREMENTS.

(1) SOFTWARE FOR PROCESSING THE SURVEY DATA SHALL BE SUBJECT TO APPROVAL BY THE CONTRACTING OFFICER. ALL SOFTWARE MUST BE ABLE TO PRODUCE FROM THE RAW SURVEY DATA RELATIVE POSITION COORDINATES *[AND CORRESPONDING VARIANCE-COVARIANCE STATISTICS WHICH IN TURN CAN BE USED AS INPUT TO THE NETWORK ADJUSTMENT PROGRAMS].

****

NOTE: Baseline output statistics are generally specified only when least squares adjustments are required, and then only if the specified adjustment software utilizes such statistics.

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(2) BASELINE PROCESSING SHALL BE COMPLETED FOR ALL BASELINES AND SELECTED FOR USE IN THE FINAL NETWORK ADJUSTMENT BASED ON AN ANALYSIS OF THE STATISTICAL DATA AND RELATIVE SPATIAL RELATIONSHIPS BETWEEN POINTS. TEST CONSTANTS GIVEN FOR A PARTICULAR SOFTWARE SYSTEM SHALL BE COMPARED TO THE PROCESSED RESULTS AND ANY SUSPECT BASELINE THAT DOES NOT MEET THE CRITERIA SHALL BE REOBSERVED OR NOT INCLUDED IN THE FINAL ADJUSTMENT. BASELINE ACCEPTANCE AND REJECTION CRITERIA ARE CONTAINED IN EM 1110-1-1004.

C.4.14. FINAL ADJUSTMENT REQUIREMENTS. SURVEY TRAVERSE LOOPS AND NETWORKS SHALL BE ADJUSTED AND EVALUATED IN ACCORDANCE WITH THE PROCEDURES AND CRITERIA IN CHAPTER 8 OF EM 1110-1-1004. FINAL VECTOR MISCLOSURES MAY BE PROPORTIONATELY DISTRIBUTED AMONG THE OBSERVED BASELINES USING EITHER APPROXIMATE OR LEAST SQUARES ADJUSTMENT TECHNIQUES DESCRIBED IN CHAPTER 8 OF EM 1110-1-1004.

(1) ADJUSTMENTS ARE NORMALLY PERFORMED USING *[SPCS] [UTM] [GEOGRAPHIC] [GEOCENTRIC] [ELLIPSOID] [OTHER] COORDINATES. TRANSFORMED FINAL ADJUSTED HORIZONTAL DATA SHALL BE EXPRESSED IN *[SPCS] [UTM] [GEOGRAPHIC] [GEOCENTRIC] [ELLIPSOID] [OTHER] COORDINATES, AND SHALL BE REFERENCED TO *[NAD 27] [NAD 83] [PROJECT] DATUM. FINAL COORDINATES SHALL BE TABULATED IN *[METERS] [FEET] [OTHER] TO ONLY *[_____] DECIMAL POINTS OF PRECISION. *[FINAL ADJUSTED VERTICAL DATA SHALL BE SHOWN AS ORTHOMETRIC HEIGHTS ON *[NGVD 29] [NAVD 88] [OTHER] VERTICAL DATUM.

SURVEY DEVELOPED ELEVATIONS SHALL BE ROUNDED TO THE NEAREST *[1/100 TH OF A] [1/10 TH OF A] [1/2 OF A] [OTHER] *[METER] [FOOT].]

(2) AN ADJUSTMENT ANALYSIS SHALL INCLUDE THE FOLLOWING:

(a) TRAVERSE LOOPS SHALL BE ANALYZED RELATIVE TO THE INTERNAL CLOSURE CRITERIA GIVEN IN TABLE 3-1 *[OR 3-2] OF EM 1110-1-1004. INTERNAL ACCEPTABILITY OF THE WORK WILL BE BASED ON THE MAGNITUDE OF THE THREE-DIMENSIONAL VECTOR MISCLOSURES RELATIVE TO THE LOOP LENGTH. SUCH LOOP CLOSURE ANALYSIS WILL BE CONSIDERED THE INTERNAL, MINIMALLY CONSTRAINED, FREE ADJUSTMENT. LOOPS/LINES WITH INTERNAL MISCLOSURE RATIOS IN EXCESS OF THOSE SPECIFIED IN THIS CONTRACT SHALL BE REOBSERVED. MISCLOSURES BETWEEN EXTERNAL FIXED CONTRAL MAY BE DISTRIBUTED USING THE APPROXIMATE DISTRIBUTION METHODS GIVEN IN EM 1110-1-1004. FINAL CONSTRAINED ACCURACY ESTIMATES WILL BE BASED ON RELATIVE MISCLOSURES AT FIXED POINTS.

****
NOTE: The following clauses apply only to rigorous least squares adjustment techniques. Note that EM 1110-1-1004 does not require that a rigorous least squares adjustment be performed for USACE control work. The guide writer must establish the technical requirement for such an adjustment to be performed for USACE control work and modify the clauses in this section accordingly.
****

(b) *WHEN A FREE (OR MINIMALLY CONSTRAINED) LEAST SQUARES ADJUSTMENT IS PERFORMED ON THE BASELINE VECTORS, A CLASSIFICATION BASED ON THIS INTERNAL ADJUSTMENT SHALL BE DERIVED AND EVALUATED AGAINST THE MINIMUM ALLOWABLE STANDARDS SHOWN IN CHAPTER 8 OF EM 1110-1-1004 FOR THE GIVEN REQUIRED ACCURACY. THIS FREE ADJUSTMENT, ALONG WITH AN ANALYSIS OF THE BASELINE REDUCTION DATA FOR THE SURVEY, WILL BE USED IN EVALUATING THE CONTRACTUAL ACCEPTABILITY OF THE OBSERVED NETWORK. STATION *[_____] SHALL BE HELD FIXED AND ANALYZED RELATIVE TO THE CRITERIA CONTAINED IN CHAPTER 8 OF EM 1110-1-1004. THE VARIANCE OF UNIT WEIGHT FOR THE MINIMALLY CONSTRAINED NETWORK ADJUSTMENT SHALL CONFORM TO THE CRITERIA GIVEN IN CHAPTER 8 OF EM 1110-1-1004. RELATIVE LINE ACCURACIES SHALL BE COMPUTED FOR PAIRS OF POINTS ON THE NETWORK USING STATISTICAL DATA CONTAINED IN THE FREE ADJUSTMENT. THESE RELATIVE LINE ACCURACIES SHALL NOT EXCEED THE REQUIRED ACCURACY CLASSIFICATIONS PRESCIBED FOR THE WORK. STATIONS/BASELINES/ NETWORK AREAS WITH FREE ADJUSTMENT RELATIVE ACCURACIES NOT MEETING THE REQUIRED CRITERIA MUST BE REOBSERVED; IT IS THEREFORE CONTINGENT ON THE CONTRACTOR TO ENSURE THAT MISCLOSURE TOLERANCES ARE CHECKED IN THE FIELD.

(c) *A CONSTRAINED LEAST SQUARES ADJUSTMENT WILL BE PERFORMED HOLDING *[FIXED] [PARTIALLY CONSTRAINED] THE COORDINATES OF THE STATIONS LISTED UNDER THE EXISTING CONTROL CLAUSE IN THIS CONTRACT SECTION. FOR THE PURPOSE OF THESE SPECIFICATIONS, BOTH FULLY CONSTRAINED AND PARTIALLY CONSTRAINED POINTS ARE REFERRED TO AS "FIXED" POINTS. *[IF USING ELLIPSOID BASED VALUES, THE CONSTRAINED LEAST SQUARES ADJUSTMENT SHALL USE MODELS WHICH ACCOUNT FOR THE REFERENCE ELLIPSOID FOR THE REFERENCE CONTROL, THE ORIENTATION AND SCALE DIFFERENCES BETWEEN THE SURVEY AND NETWORK CONTROL DATUMS, GEOID-ELLIPSOID RELATIONSHIPS, AND DISTORTIONS AND/OR RELIABILITY IN THE NETWORK CONTROL.]

****

NOTE: A variety of free and/or constrained adjustment combinations may be specified. Specific stations to be held fixed may have been indicated in a prior contract section or the contractor may be instructed to determine the optimum adjustment, including appropriate weighting for constrained points. When fixed stations are to be partially constrained, then appropriate statistical information must be provided -- either variance-covariance matrices or relative positional accuracy estimates which may be converted into approximate variance-covariance matrices in the constrained adjustment.

****

[1] WHEN DIFFERENT COMBINATIONS OF CONSTRAINED ADJUSTMENTS ARE PERFORMED DUE TO INDICATIONS OF ONE OR MORE FIXED STATIONS CAUSING UNDUE BIASING OF THE DATA, AN ANALYSIS SHALL BE MADE AS TO RECOMMENDED SOLUTION WHICH PROVIDES THE BEST FIT FOR THE NETWORK. ANY FIXED CONTROL POINTS WHICH SHOULD BE READJUSTED (TO ANOMALIES FROM THE ADJUSTMENT(S)) SHOULD BE CLEARLY INDICATED IN A FINAL ANALYSIS RECOMMENDATION.

[2] THE FINAL ADJUSTED HORIZONTAL AND/OR VERTICAL COORDINATE VALUES SHALL BE ASSIGNED AN ACCURACY CLASSIFICATION BASED ON THE ADJUSTMENT RESULTS AND IN ACCORDANCE WITH THE CRITERIA INDICATED IN TABLE 3-1 AND/OR TABLE 3-2 OF EM 1110-1-1004. THESE CLASSIFICATIONS SHALL INCLUDE BOTH THE RESULTANT GEODETIC/CARTESIAN COORDINATES AND THE SURVEY RESULTS. THE FINAL ADJUSTED COORDINATES SHALL STATE THE 95 PERCENT CONFIDENCE REGION OF EACH POINT AND THE (TWO-SIGMA) RELATIVE LINE ACCURACY BETWEEN ALL POINTS IN THE NETWORK.

(3) FINAL ADJUSTED COORDINATE LISTING SHALL BE PROVIDED ON HARD COPY *[AND ON] *[___] [specify] COMPUTER MEDIA].

(4) *A SCALED PLOT SHALL BE SUBMITTED WITH THE ADJUSTMENT REPORT SHOWING THE PROPER LOCATIONS AND DESIGNATIONS OF ALL STATIONS ESTABLISHED.

C.5 SUBMITTAL REQUIREMENTS:

C.5.1. SUBMITTAL SCHEDULE: THE COMPLETED SURVEY REPORT SHALL BE DELIVERED WITHIN *[____ DAYS AFTER NOTICE TO PROCEED IS ISSUED] *[BY calendar date].

****

NOTE: Include a more detailed submittal schedule breakdown if applicable to project.

****

C.5.2. SUBMITTED ITEMS: SUBMITTALS SHALL CONFORM TO THOSE SPECIFIED IN EM 1110-1-1004 *[EXCEPT AS MODIFIED HEREIN].

****

NOTE: Reference EM 1110-1-1004 for type survey submittal requirements. Modify and/or add items as required.

****

C.5.3. PACKING AND MARKING: COMPLETED WORK SHALL BE PACKAGED TO PROTECT THE MATERIALS FROM HANDLING DAMAGE. EACH PACKAGE SHALL CONTAIN A TRANSMITTAL LETTER OR SHIPPING FORM, IN DUPLICATE, LISTING THE MATERIALS BEING TRANSMITTED, BEING PROPERLY NUMBERED, DATED, AND SIGNED. SHIPPING LABELS SHALL BE MARKED AS FOLLOWS:

U.S. ARMY ENGINEER DISTRICT, _____
ATTN: _____
*[include office symbol and name]
CONTRACT NO. _____
*[DELIVERY ORDER NO. _____]
[STREET/PO BOX] _____
*[complete local mailing address]

*HAND-CARRIED SUBMISSION SHALL BE PACKAGED AND MARKED AS ABOVE, AND DELIVERED TO THE FOLLOWING OFFICE ADDRESS:

_____
*[insert office/room number as required]

****

NOTE: In this section, also reference any automated data submittal requirements for survey observations, if applicable.

****

C.6 PROGRESS SCHEDULES AND WRITTEN REPORTS.

C.6.1. *PREWORK CONFERENCE:

****

NOTE: Detail any requirements for a prework conference after contract award, including requirements for preparing written reports for such conferences.

****

SECTION D

CONTRACT ADMINISTRATION DATA

SECTION E

SPECIAL CONTRACT REQUIREMENTS

SECTION F

CONTRACT CLAUSES

****

NOTE: Detailed guidance for preparing the above contract sections is contained in EFARS.

****

SECTION G

LIST OF ATTACHMENTS

G.1. U.S. ARMY CORPS OF ENGINEERS EM 1110-1-1004, DEFORMATION MONITORING AND CONTROL SURVEYING . THIS REFERENCE IS ATTACHED TO AND MADE PART OF THIS CONTRACT.

****

NOTE: List any other attachments called for in contract Section C or in other contract sections. This includes items such as:

a. Marked-up project sketches/drawings.
b. Station/monument descriptions or recovery notes.
c. Lists of connections to existing network.
d. Lists of fixed (existing) stations to be connected with and adjusted to.
e. Drafting standards.
f. CADD standards.

****

SECTION H

REPRESENTATIONS, CERTIFICATIONS, AND OTHER STATEMENTS OF OFFERERS

SECTION I

INSTRUCTIONS, CONDITIONS, AND NOTICES TO OFFERERS

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NOTE: See EFARS for guidance in preparing these clauses/provisions.

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